

## **Glossary of Ozone Related Terms**

**aerosol** - Gaseous suspension of fine particles. May serve as nuclei for condensation in the atmosphere.

**albedo** - Portion of incident electromagnetic radiation that is reflected by Earth's surface.

**aldehyde** - Organic chemical compound derived from the oxidation of primary alcohols, having the common group CHO. Used in manufacturing of dyes, resins, and organic acids.

**anaerobic** - Capable of living in the absence of free oxygen.

**anthropogenic** - Involving the impact of man on the natural environment.

**anticyclone** - Extensive wind system, of high barometric pressure, that circulates clockwise in the Northern hemisphere and counterclockwise in the Southern hemisphere.

**atmosphere** - Envelope of air surrounding Earth, which is retained

**Chapman Reactions** - Stratospheric reactions in which ozone dissociates into molecular oxygen and atomic oxygen, and the resulting free oxygen atoms recombine with ozone to form molecular oxygen. The process was first described by a British physicist named Sydney Chapman in 1930.

**chlorine (Cl)** - Heavy, greenish-yellow, irritating gas with a pungent odor. Capable of reacting with almost all other elements. Catalyst for ozone destruction.

**chlorine monoxide (ClO)** - Intermediate product of chlorine interaction with ozone.

**chlorine nitrate (ClONO<sub>2</sub>)** - Compound formed by the reaction of ClO and NO<sub>2</sub>. Slows the rate of ozone destruction, as it is much less reactive than ClO. May also react to produce HOCl, which is rapidly photolyzed into Cl and ClO, reactive chlorine and chlorine monoxide.

**chlorofluorocarbons (CFCs)** - Group of inert, nontoxic, nonflammable compounds made up of chlorine, fluorine, and carbon; used in cooling, foam insulation and cleaning agents as well as aerosol propellants.

**chopper disk/motor** - Slotted disk that is rotated by an electrical motor. During rotation, the detector views the target and reference source alternately. The known radiance from the reference source and the amplitude of the incoming signal enable estimation of the target's radiance.

**climatological ozone profiles** - Twenty-three standard profiles derived from a combination of SBUV measurements taken at altitudes greater than 16-mbar and low altitude balloon radiosonde data. Yearly averages were developed for three latitude bands: low (15°), mid (45°), and high (75°).

**climatological temperature profiles** - Standard temperature profiles obtained from the Environmental Science Services Administration.

**convective** - The transfer of heat through motion within the atmosphere, especially upward directed motion.

**deoxyribonucleic acid (DNA)** - Self replicating nucleic acid that contains genetic code within the cell. The primary structure consists of two long nucleotide chains that are joined by hydrogen bonds and twisted together to form a double helix.

**depolarizer** - Device that removes the effects of polarization.

**dichlorofluoromethane (CF<sub>2</sub>Cl<sub>2</sub>)** - Halocarbon compound used in air conditioning systems as a refrigerant. One of two primary chlorofluorocarbons that photolyze at high altitudes to release chlorine atoms. An important factor in ozone depletion.

**diffuser plate** - Plate used for capturing incoming solar radiation for measurement and intercepting radiation from a mercury-argon calibration lamp.

**digital accumulators** - Devices within an electronic system that serve to integrate and demodulate frequency output signals from the voltage to frequency converter (VFC). Work synchronously with the chopper motor.

**Dobson Unit (DU)** - Unit of measurement of total ozone equal to  $2.69 \times 10^{16}$  molecules per square centimeter. An equivalent amount of ozone, at 1 atmosphere and 273• K, would form a layer 0.001 cm thick. Named in honor of the British physicist G. M. B. Dobson.

**Ebert-Fastie monochromatic spectrometer** - Instrument used to measure energy intensity within the ultraviolet region of the electromagnetic spectrum.

**electromagnetic spectrum (EMS)** - Entire range of electromagnetic radiation ranging from gamma rays, less than 0.03 nanometers, to radio waves, greater than or equal to 30 centimeters.

**exit slits** - Array of holes within a chopper disk that serve as fixed exits during wavelength calibration.

**exosphere** - Region of the atmosphere beyond 400 km. that fades into interplanetary space.

**hypertext links** - Executable links to external programs or modules. Commonly used by selecting a uniquely formatted field, such as highlighted text, to access detailed information.

**instantaneous field of view (IFOV)** - Ground or target area viewed by a sensor at a given point in time.

**infrared radiation** - Electromagnetic radiation having a wavelength slightly longer than visible red light, from 750 nanometers to 1 millimeter.

**infrared radiometer** - Sensor that measures the intensity of infrared radiation (720 nm-1500 nm) within a specific field of view.

**irradiance** - Radiant flux per unit area of a surface.

**ketones** - Organic compounds in which the carbon atoms of two hydrocarbon radicals are linked to a carbonyl group. Generally represented by the formula  $R(CO)R_1$ , where  $R_1$  and  $R$  may be the same.

**kinetic** - Of or relating to the motion of material bodies and associated forces and energy.

**lithosphere** - Solid mass of Earth composed of rock, soil, and sediment.

**mercury-argon calibration lamp** - Lamp that produces radiation centered at 253.7 nm, which is then diffused from a diffuser plate. Radiation measurements are made at multiple wavelengths and possible shifts are noted.

**mesopause** - Transitional atmospheric region between the mesosphere and thermosphere.

**mesosphere** - Region of the atmosphere, between approximately 50 to 100 km, in which temperature decreases with altitude.

**Meteor-3** - Third in a series of weather satellites launched by the former Soviet Union. Launched in August 1991 with a payload that included a Total Ozone Mapping Spectrometer (TOMS).

**methane** - Simple combustible hydrocarbon. The major component of natural gas.

**microwave radiometer** - Sensor that measures the intensity of microwave radiation (0.3 cm-30 cm) within a specific field of view.

**mie scattering** - Atmospheric scattering caused by large particles such as dust, pollen, smoke, and water droplets. More prevalent in the lower atmosphere, from 0 to 5 km.

**mixing ratio** - Relative number of molecules of a specific type in a given volume of air.

**monochromator** - Spectrometer that operates within a narrow range of the electromagnetic spectrum.

**nadir** - Point directly beneath a satellite, opposite the satellite zenith.

**Nimbus-7** - Polar orbiting satellite launched on October 24, 1978, as a research and development satellite to enable multidisciplinary studies of pollution, oceanography, and meteorology. The following instruments were onboard: coastal zone color scanner (CZCS), earth radiation budget (ERB), limb infrared monitor of the stratosphere (LIMS), stratospheric aerosol measurement II (SAM II), stratospheric and mesospheric sounder (SAMS), solar backscatter ultraviolet explorer total ozone mapping spectrometer (SBUV TOMS), scanning multichannel microwave radiometer (SMMR), and temperature humidity infrared radiometer (THIR).

**nitrogen** - A colorless, odorless, nonmetallic element that occurs as a diatomic gas and constitutes nearly 80% of the atmosphere by volume.

**nitrous oxide (N<sub>2</sub>O)** - Colorless gas, naturally produced through bacteriological decomposition of organic matter. Also produced anthropogenically and used as a mild anesthetic.

**optical spectrum** - Portion of the electromagnetic spectrum, from 0.30 to 15 micrometers, that can be reflected and refracted with mirrors and lenses.

**oxygen** - A nonmetallic element that occurs as a diatomic gas and constitutes 21% of air by volume, essential for plant and animal respiration, and required for almost all combustion.

**ozone** - Gaseous compound of three oxygen atoms that is generated by a photo-electro process and has a distinct electrical or disinfectant odor. Forms a thin layer in the atmosphere that absorbs harmful solar ultraviolet radiation.

**ozone absorption coefficients** - Variable parameter inputs required for albedo calculations. Albedo measurements across an entrance slit vary according to ozone concentrations and temperature. Therefore, an integral of measurements is used in albedo calculations.

**ozone depletion** - Loss of ozone through natural breakdown and anthropogenically produced chemical reactions.

**ozone hole** - Region of rapid, dramatic ozone depletion over Antarctica during the polar spring. Confined to south of 55° latitude. Disperses soon after temperatures rise above -80° C.

**pair values** - Ratio of the albedo value at a longer ozone-insensitive wavelength to the albedo value at a shorter ozone-sensitive wavelength. Used in the computation of ozone.

**peroxyacyl nitrates (PAN)** - Damaging photochemical oxidants that are very irritating to the eyes and throat. Represented as R(CO)OO(NO<sub>2</sub>) where R denotes a hydrocarbon ring or chain.

**photochemical** - Of or relating to the effect of radiant energy on a chemical system.

**photolysis** - Dissociation process driven by the Sun's radiation.

**photomultiplier tube (PMT)** - Photoemissive detector consisting of a photocathode and fused silica window that work together to multiply an incoming electron beam.

**photosynthesis** - Chemical process driven by solar energy in which CO<sub>2</sub> and H<sub>2</sub>O, in the presence of chlorophyll, are converted to oxygen and carbohydrates. Oxygen and water vapor are released in the process.

**polarization** - Uniform and nonrandom elliptical, circular, or linear variation of a wave, characteristic in light or other radiation.

**polar stratospheric clouds** - High, thin clouds composed of nitric acid and water that form in the coldest regions of the stratosphere when temperatures drop below -80°C. Ice crystal surfaces within these clouds are efficient in converting inert chlorine reservoirs, such as ClONO<sub>2</sub> and HCl, into reactive chlorine compounds.

**polar vortex** - Wind region around the North or South pole. The southern vortex is a well formed circular to oblong mass of extremely cold, stagnant air, held in place by the ocean surrounding the Antarctic land mass and a strong westerly circulation pattern produced by the coriolis effect. The northern vortex is not as distinct because the Arctic is a frozen ocean

surrounded by rugged land masses, which cause the circulating winds to encounter a variety of temperatures.

**Precambrian** - Of or pertaining to the earliest geologic period of history, approximately 600 million years ago.

**quasi-biennial oscillation** - Periodic variation in the direction, either easterly or westerly, of tropical lower stratospheric winds. The direction changes every 26 months.

**radiosonde** - Balloon borne instrument used to measure and transmit meteorological data.

**Rayleigh scattering** - Dominant form of light scattering in the upper atmosphere, which produces the blue color of the sky. It is caused by atmospheric particulates that have very small diameters relative to the wavelength of the light, such as dust particles or atmospheric gases like nitrogen and oxygen.

**reflective spectrum** - Portion of the optical spectrum, from approximately 0.38 to 15 micrometers, that defines the direct solar radiation used in remote sensing.

**reflectivity** - Ratio of intensity of the total radiation reflected from a surface to the total radiation incident on the surface.

**satellite zenith angle** - Angle between the position of a satellite and the zenith, which is the point directly over the observed target.

**signal processor** - Processor located within the electronics system, that consists of multiple voltage to frequency converters that are responsible for converting an incoming signal from optical to digital.

**solar cycle** - Periodic change in sunspot activity. One cycle is approximately 11.1 years.

**solar vector** - Direction of an incoming solar radiation beam. Used in conjunction with the position of a spectrometer's diffuser plate to calculate albedo.

**solar zenith angle** - Angle between the position of the Sun and the zenith, which is the point directly over an observed target.

**spectrometer** - Instrument used to determine the distribution of energy within a spectrum of wavelengths.

**stratopause** - Transition layer between the stratosphere and mesosphere. Marks the maximum altitudinal temperature increase within the stratosphere.

**stratosphere** - Portion of the atmosphere between the tropopause, at approximately 8 to 15 km, and 50 km in altitude, depending upon latitude, season, and weather.

**sulfur dioxide (SO<sub>2</sub>)** - Chemical compound that absorbs radiation of the same wavelength absorbed by ozone. Product of large volcanic eruptions.

**sulfuric acid (H<sub>2</sub>SO<sub>4</sub>)** - Heavy, corrosive, oily acid. Vigorous

oxidizing agent. Ozone concentrations may be affected by reactions on the surface of sulfuric acid clouds, resulting from major volcanic eruptions.

**sunspot** - Relatively dark, sharply defined region on the Sun associated with an intense magnetic field.

**surface pressure** - Pressure at an observation point on Earth's surface.

**thermopause** - Transition layer between the thermosphere and exosphere, located at approximately 600km in altitude.

**thermosphere** - Region of the atmosphere in which temperature increases with altitude. Located at approximately 100 to 400 km.

**TOMS** - Total Ozone Mapping Spectrometer. Launched on the NASA Nimbus-7 satellite. Monitored Earth between October 31, 1978, and May 6, 1993.

**total column ozone** - Amount of ozone, measured from Earth's surface to the top of the atmosphere, over a given surface area.

**trichlorofluorocarbon (CFCI<sub>3</sub>)** - Halocarbon compound used in aerosols. One of two primary chlorofluorocarbons that photolyze at high altitudes to release chlorine atoms. An important factor in ozone depletion.

**tropopause** - Boundary between the troposphere and stratosphere, from 8 km in the polar regions to 15 km in the tropics. Marks the vertical limit of most weather phenomena.

**troposphere** - Lowest region of the atmosphere, defined by a steady decrease in temperature with altitude. Extends to approximately 15 km above Earth's surface.

**tropospheric** - Having to do with the lowest region of the atmosphere, which extends to approximately 15 km above Earth's surface.

**UARS** - Upper Atmosphere Research Satellite. NASA satellite launched in September 1991. Platform for instruments to measure temperature, wind, and composition of the upper atmosphere, including the stratosphere.

**ultraviolet (UV)** - Invisible, short wavelength region of the solar spectrum, from approximately 4 to 380 nanometers.

**voltage-to-frequency converters (VFC)** - Components of the Total Ozone Mapping Spectrometer that convert incoming voltage current from the chopper and electrometer to frequencies that are sent through the electronics system.

**wavelength** - Distance between two corresponding points within consecutive waves, such as the peak or crest of each.